In this technological age, mathematics is more important than ever. When students leave school, they are more and more likely to use mathematics in their work and everyday lives — operating computer equipment, planning timelines and schedules, reading and interpreting data, comparing prices, managing personal finances, and completing other problem-solving tasks. What they learn in mathematics and how they learn it will provide an excellent preparation for a challenging and ever-changing future.

The state of Indiana has established the following mathematics standards to make clear to teachers, students, and parents what knowledge, understanding, and skills students should acquire in Grade 2:

Standard 1 — Number Sense

Understanding the number system is the basis of mathematics. Students develop this understanding by first using sets of objects and then moving on to writing numbers in figures. They learn how we group numbers in tens and ones, which allows them to write numbers up to 100. They count by ones, twos, fives, and tens. They find the number ten more or ten less than a given number. They identify odd and even numbers and put numbers in order of size. They use the terms first, second, third, etc. Students also extend their knowledge of fractions, including learning how to compare the sizes of simple fractions.

Standard 2 — Computation

Fluency in computation is essential. As students learn about the whole numbers up to 100, they also learn how to add and subtract them. They use objects to join sets together (for addition) and to remove objects from sets (for subtraction). They also learn to add and subtract with figures using mental arithmetic.

Standard 3 — Algebra and Functions

Algebra is a language of patterns, rules, and symbols. Students at this level make simple patterns with numbers and continue these number patterns using addition and subtraction. They also relate word problems to number sentences such as $28 - 15 = 13$ and use rules for addition to check results.

Standard 4 — Geometry

Students learn about geometric shapes and develop a sense of space. They identify and describe simple shapes, such as circles, triangles, squares, rectangles, and cubes. Students construct simple two- and three-dimensional shapes and describe and sort them using their faces, edges, and corners. They identify shapes that are congruent (i.e., the same shape and size). They also investigate how shapes are made from other shapes and recognize geometric shapes in the world around them.

Standard 5 — Measurement

The study of measurement is essential because of its uses in many aspects of everyday life. Students measure in order to compare objects' lengths, areas, weights, temperatures, etc. They learn why we use standard units of length (inch, foot, yard, centimeter, and meter) and measure objects using these units. In a similar way, they learn how to measure weight, capacity, and temperature in standard units. They also learn about time (hours in a day, months in a year, etc.) and how to tell the time on a clock to the nearest five minutes. They learn about money: the values of the coins and the value of a collection of coins and dollars.

Standard 6 — Problem Solving

In a general sense, mathematics is problem solving. In all mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results. As they develop their skills with numbers, geometry, or measurement, for example, students move from simple ideas to more complex ones by taking logical steps that build a better understanding of mathematics.

As part of their instruction and assessment, students should also develop the following learning skills by Grade 12 that are woven throughout the mathematics standards:

Communication

The ability to read, write, listen, ask questions, think, and communicate about math will develop and deepen students' understanding of mathematical concepts. Students should read text, data, tables, and graphs with comprehension and understanding. Their writing should be detailed and coherent, and they should use correct mathematical vocabulary. Students should write to explain answers, justify mathematical reasoning, and describe problem-solving strategies.

Reasoning and Proof

Mathematics is developed by using known ideas and concepts to develop others. Repeated addition becomes multiplication. Multiplication of numbers less than ten can be extended to numbers less than one hundred and then to the entire number system. Knowing how to find the area of a right triangle extends to all right triangles. Extending patterns, finding even numbers, developing formulas, and proving the Pythagorean Theorem are all examples of mathematical reasoning. Students should learn to observe, generalize, make assumptions from known information, and test their assumptions.

Representation

The language of mathematics is expressed in words, symbols, formulas, equations, graphs, and data displays. The concept of one-fourth may be described as a quarter, $\frac{1}{4}$, one divided by four, 0.25, $\frac{1}{8} + \frac{1}{8}$, 25 percent, or an appropriately shaded portion of a pie graph. Higher-level mathematics involves the use of more powerful representations: exponents, logarithms, π, unknowns, statistical representation, algebraic and geometric expressions. Mathematical operations are expressed as representations: $+$, $=$, divide, square. Representations are dynamic tools for solving problems and communicating and expressing mathematical ideas and concepts.

Connections

Connecting mathematical concepts includes linking new ideas to related ideas learned previously, helping students to see mathematics as a unified body of knowledge whose concepts build upon each other. Major emphasis should be given to ideas and concepts across mathematical content areas that help students see that mathematics is a web of closely connected ideas (algebra, geometry, the entire number system). Mathematics is also the common language of many other disciplines (science, technology, finance, social science, geography) and students should learn mathematical concepts used in those disciplines. Finally, students should connect their mathematical learning to appropriate real-world contexts.

Standard 1

Number Sense

Students understand the relationships among numbers, quantities, and place value in whole numbers up to 100. They understand that fractions may refer to parts of a set* and parts of a whole.*

2.1.1 Count by ones, twos, fives, and tens to 100.

Example: Count 74 pencils by groups of tens and twos.

2.1.2 Identify the pattern of numbers in each group of ten, from tens through nineties.

Example: What pattern do you see on a hundreds chart for the numbers 12, 22, 32, etc.?

2.1.3 Identify numbers up to 100 in various combinations of tens and ones.

Example: 32 = 3 tens + 2 ones = 2 tens + 12 ones, etc.

2.1.4 Name the number that is ten more or ten less than any number 10 through 90.

Example: Name the number ten more than 54.

2.1.5 Compare whole numbers up to 100 and arrange them in numerical order.

Example: Put the numbers in order of size: 95, 28, 42, 31.

2.1.6 Match the number names (*first*, *second*, *third*, etc.) with an ordered set of up to 100 items.

Example: Identify the seventeenth letter of the alphabet.

2.1.7 Identify odd and even numbers up to 100.

Example: Find the odd numbers in this set: 44, 31, 100, 57, 28.

2.1.8 Recognize fractions as parts of a whole or parts of a group (up to 12 parts).

Example: Divide a cardboard rectangle into 8 equal pieces. Shade 5 pieces and write the fraction for the shaded part.

2.1.9 Recognize, name, and compare the unit fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$, and $\frac{1}{12}$.

Example: Which is larger, $\frac{1}{3}$ or $\frac{1}{6}$? Explain your answer.

2.1.10 Know that, when all fractional parts are included, the result is equal to the whole and to one.

Example: What is another way of saying six sixths? Explain your answer.

2.1.11 Collect and record numerical data in systematic ways.

Example: Measure the hand span in whole centimeters of each student in your class. Keep a record of the answers they give you.

2.1.12 Represent, compare, and interpret data using tables, tally charts, and bar graphs.

Example: Make a tally of your classmates' favorite colors and draw a bar graph. Name the color that is most popular and the color that is the favorite of the fewest people.

* whole number: 0, 1, 2, 3, etc.

* set: collection of objects, numbers, etc.

Standard 2

Computation

Students solve simple problems involving addition and subtraction of numbers up to 100.

2

2.2.1 Model addition of numbers less than 100 with objects and pictures.

Example: Use blocks to find the sum of 26 and 15.

2.2.2 Add two whole numbers less than 100 with and without regrouping.

Example: $36 + 45 = ?$.

2.2.3 Subtract two whole numbers less than 100 without regrouping.

Example: $86 - 55 = ?$.

2.2.4 Understand and use the inverse relationship between addition and subtraction.

Example: Understand that $89 - 17 = 72$ means that $72 + 17 = 89$.

2.2.5 Use estimation to decide whether answers are reasonable in addition problems.

Example: Your friend says that $13 + 24 = 57$. Without solving, explain why you think the answer is wrong.

2.2.6 Use mental arithmetic to add or subtract 0, 1, 2, 3, 4, 5, or 10 with numbers less than 100.

Example: In a game, Mia and Noah are making addition problems. They make two two-digit numbers out of the four given numbers 1, 2, 3, and 4. Each number is used exactly once. The winner is the one who makes two numbers whose sum is the largest. Mia had 24 and 31; Noah had 21 and 43. Who won the game? How do you know? Show a way to beat both of them.

Standard 3

Algebra and Functions

Students model, represent, and interpret number relationships to create and solve problems involving addition and subtraction.

2.3.1 Relate problem situations to number sentences involving addition and subtraction.

Example: You have 13 pencils and your friend has 12 pencils. You want to know how many pencils you have altogether. Write a number sentence for this problem and use it to find the total number of pencils.

2.3.2 Use the commutative* and associative* properties for addition to simplify mental calculations and to check results.

Example: Add the numbers 5, 17, and 13 in this order. Now add them in the order 17, 13, and 5. Which was easier? Why?

2.3.3 Recognize and extend a linear pattern by its rules.

Example: One horse has 4 legs, two horses have 8 legs, and so on. Continue the pattern to find how many legs five horses have.

2.3.4 Create, describe, and extend number patterns using addition and subtraction.

Example: What is the next number: 23, 21, 19, 17, …? How did you find your answer?

* commutative property: the order when adding or multiplying numbers makes no difference (e.g., $5 + 3 = 3 + 5$), but note that this is not true for subtraction or division

* associative property: the grouping when adding or multiplying numbers makes no difference (e.g., in $5 + 3 + 2$, adding 5 and 3 and then adding 2 is the same as 5 added to $3 + 2$), but note that this is not true for subtraction or division

Standard 4

Geometry

Students identify and describe the attributes of common shapes in the plane and of common objects in space.

2.4.1 Construct squares, rectangles, triangles, cubes, and rectangular prisms* with appropriate materials.

Example: Use blocks to make a rectangular prism.

2.4.2 Describe, classify, and sort plane and solid geometric shapes (triangle, square, rectangle, cube, rectangular prism) according to the number and shape of faces* and the number of sides, edges, and/or vertices*.

Example: How many vertices does a cube have?

2.4.3 Investigate and predict the result of putting together and taking apart two-dimensional and three-dimensional shapes.

Example: Use objects or a drawing program to find other shapes that can be made from a rectangle and a triangle. Use sketches or a drawing program to show several ways that a rectangle can be divided into three triangles.

2.4.4 Identify congruent* two-dimensional shapes in any position.

Example: In a collection of rectangles, pick out those that are the same shape and size.

2.4.5 Recognize geometric shapes and structures in the environment and specify their locations.

Example: Look for combinations of shapes in the buildings around you.

* rectangular prism: a box with six rectangles for sides, like a cereal box
* face: a flat side, like the front of the cereal box
* vertices: corners (vertex: corner)
* congruent: the term to describe two figures that are the same shape and size

Standard 5

Measurement

Students understand how to measure length, temperature, capacity, weight, and time in standard units.

2.5.1 Measure and estimate length to the nearest inch, foot, yard, centimeter, and meter.

Example: Measure the length of your classroom to the nearest foot.

2.5.2 Describe the relationships among inch, foot, and yard. Describe the relationship between centimeter and meter.

Example: How many inches are in a yard?

2.5.3 Decide which unit of length is most appropriate in a given situation.

Example: Would you use yards or inches to measure the length of your school books? Explain your answer.

2.5.4 Estimate area and use a given object to measure the area of other objects.

Example: Make a class estimate of the number of sheets of notebook paper that would be needed to cover the classroom door. Then use measurements to compute the area of the door.

2.5.5 Estimate and measure capacity using cups and pints.

Example: Make a reasonable estimate of the number of pints a juice pitcher holds.

2.5.6 Estimate weight and use a given object to measure the weight of other objects.

Example: About how many jellybeans will you need to put on one side of a balance scale to balance with a box of chalk? Count out the number of jellybeans that you guessed would be needed and see whether your estimate was close. Explain the results of your estimation and weighing.

2.5.7 Recognize the need for a fixed unit of weight.

Example: Estimate the number of paperclips needed to balance with a box of chalk. Will it be the same as the number of jellybeans? Explain your answer.

2.5.8 Estimate temperature. Read a thermometer in Celsius and Fahrenheit.

Example: What do you think the temperature is today? Look at the thermometer to check.

2.5.9 Tell time to the nearest quarter hour, be able to tell five-minute intervals, and know the difference between a.m. and p.m.

Example: When does your favorite TV program start?

2.5.10 Know relationships of time: seconds in a minute; minutes in an hour; hours in a day; days in a week; and days, weeks, and months in a year.

Example: How many days are in a year?

2.5.11 Find the duration of intervals of time in hours.

Example: Your trip began at 9:00 a.m. and ended at 3:00 p.m. How long were you traveling?

2.5.12 Find the value of a collection of pennies, nickels, dimes, quarters, half-dollars, and dollars.

Example: You have 3 pennies, 4 nickels, and 2 dimes. How much money do you have? Explain your answer.

Standard 6

Problem Solving

Students make decisions about how to set up a problem.

2.6.1 Choose the approach, materials, and strategies to use in solving problems.

Example: Solve the problem: "Count the number of squares on the surface of a cube. Put two cubes together and count the number of visible squares. Repeat this step with 3, 4, 5, …, cubes in a line. Find a rule for the number of squares." Use blocks to set up the problem.

2.6.2 Use tools such as objects or drawings to model problems.

Example: In the first example, place blocks together. Each time you add a block, count the number of squares and record it.

Students solve problems and justify their reasoning.

2.6.3 Explain the reasoning used and justify the procedures selected in solving a problem.

Example: In the first example, notice that the number goes up by 4 each time a block is added. Observe that, as you add each cube, you gain 6 squares but lose 2 where the blocks are joined.

2.6.4 Make precise calculations and check the validity of the results in the context of the problem.

Example: In the first example, check your results by setting out 10 blocks and counting the number of squares on each long side and then the two at the ends. See how this fits with your rule of adding 4 each time.

2.6.5 Understand and use connections between two problems.

Example: Use the method of the problem you have just solved to find what happens when the cubes are not all in a line.

NOTES